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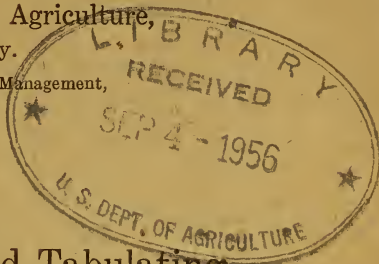
Issued January 7, 1916.

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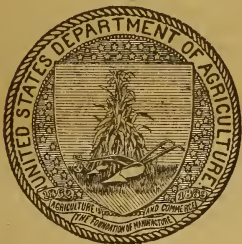
Contribution from the Office of Farm Management,

W. J. SPILLMAN, Chief.



Suggestions
Concerning Checking and Tabulating
Farm Management Survey Data.

A DESK MANUAL FOR
INVESTIGATORS.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1916.

FARM MANAGEMENT DEPARTMENT,
UTAH AGRICULTURAL COLLEGE



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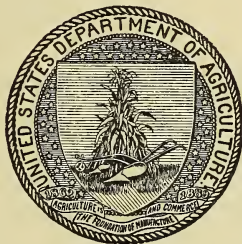
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CHECKING AND TABULATING FARM MANAGEMENT SURVEY DATA.

The value of the farm management survey as a means of analyzing the agriculture of a locality is now quite generally recognized. Such an analysis reveals both the points of excellence and the defects of the local farming. The difficulties connected with work of this character and the very general interest in it render it desirable to set forth the methods required for satisfactory work. So far as may be at the present time, this is done in the following pages. It is assumed that the reader is familiar with the methods of gathering such data in the field. It is the use of the data after it is collected that is here considered. The subject will be briefly treated from the following standpoints:

1. Checking the office sheets.
2. Preliminary calculations.
3. Principles of tabulation.
4. Classification of farms by tenure.
5. Suggested tables.

CHECKING SURVEY RECORDS.

Survey records are taken on field blanks and later transferred to the survey record sheet, or office blank. These transfers should be made daily as the collecting of the data progresses. They should then be checked in accordance with the suggestions below, and where inconsistency or incompleteness is found, another visit should be made to the farm. Where a survey party consists of several men, one member should be expert in checking records. At the close of each day's work each field man transfers his records from the field blanks to the office blanks. The next day the office man checks these records while the field men are taking new records. In case the checking shows inconsistency or lack of necessary data,

the same field man who took the original record goes back to the farmer concerned and gets the additional data.

A survey record generally consists of estimates made by the farmer as to the details of his business for the past year. Most farmers have the details of their business sufficiently in mind to give a satisfactory record, but in some cases it requires great skill on the part of the field man in reducing his questions to the terms in which the farmer thinks in order to get trustworthy information.

If a record is grossly inaccurate this fact is easily detected by the system of checking outlined below. Even if it is only slightly inaccurate this fact will usually show because of the numerous checks in the records themselves. The following is an outline of the work to be done in checking a record:

1. Compare the office sheet with the field blanks to see if all the transfers have been correctly made.

2. See if the total acres of crops, pastures, woodland, etc., equals the total farm area.

3. Examine the yields of the crops per acre to see if they are reasonable when compared with the normal for the year and locality. (See next paragraph.)

4. Examine the sales to see if prices and amounts sold are reasonable. If the price is unusual, there should be an explanation on the field sheet. In general, any unusual item on a field blank should be accompanied by a note of explanation, to show it is not merely an error.

5. Balancing the live stock. Certain inconsistencies in the live-stock record may be detected as follows:

Cows.—If the number of cows on hand at the first inventory be added to the purchases and the sum be subtracted from the sum of the second inventory plus sales, plus number died, the difference will show the number of heifers added to the herd during the year. Suppose this difference is six and that in the first inventory only four heifers were shown and that one heifer was purchased. This shows a mistake of at least one either in the number of cows or in the number of heifers. The number of heifers that became cows during the year might be zero in such a case, no matter how many heifers were on hand the first of the year. The point is: If the number of heifers added to the herd during the year, as determined from the number of cows, is greater than the total number

of heifers on hand at the beginning of the year plus the number of heifers purchased, the record must be wrong.

Heifers.—The record of the heifers may be checked with that of the calves in a similar manner. In checking the record of the cows we find the number of heifers that became cows during the year. Add together the number of heifers in the second inventory, the number sold, the number that died, and the number that became cows; from this sum subtract the number in the first inventory plus the number purchased; the difference will be the number of calves that passed into the heifer class during the year. This number must not exceed the number of calves at the first inventory plus the number purchased.

Calves.—To find the number of calves born, add together the number at the second inventory, the number sold, the number that died, and the number that passed into the heifer class (determined in checking the heifer data), and the number that passed into the steer class, and subtract the number at the first inventory and the number bought. The number born should be consistent with the number of cows on hand.

Horses.—In the case of horses, add together the number at the second inventory, the number sold, and the number that died. Subtract from this the number at the first inventory plus the number purchased. The difference, if any, must be made up by colts passing from the colt class to the horse class during the year. If this number is greater than the number of colts on hand at the first inventory plus the number purchased, the record is wrong.

6. See if the amount of stock products sold is consistent with the number of animals on hand. If the receipts per cow figure out over \$100 each, note whether the cows are high priced. They should be with such a product. On the other hand, if the receipts per cow are very low, the cows should be low priced. If the figures indicate a very high yield of wool per sheep, the price of sheep should be correspondingly high, and vice versa. If a stallion is shown in the inventory, look for breeding fees in the miscellaneous receipts. If animals died or were butchered, look for receipts from hides in miscellaneous receipts.

7. Examine the list of current expenses for the following points: Is the amount of labor, repairs, etc., consistent with the area of crops, the number of stock kept, etc.? If colts are reported and no stallion kept, there should be an item for breeding fees in current expenses. If the farm has no bull, there should be an item for breeding fees for calves in current expenses. If the farmer

raises grain, but has no drill, binder, etc., there should be an item for machinery hire. If truck crops or fruit are sold, there should be an expense for barrels, bags, crates, etc. If the farmer retails milk, fruit, truck, etc., there should be a relatively large equipment in horses, wagons, etc., and a larger labor bill than on a similar farm which sells wholesale. If an engine is included in the list of machinery, there should be items for fuel and oil. If there is grain to thrash, clover to hull, etc., there should be an item for fuel and thrashing. If hay is sold, look for baling charges. An unusually large labor bill might be explained by machine work done for others or other outside work; also, by the construction of buildings, of laying tile drains, or building of fences, etc.

If the area of pasture is large and the live-stock inventory shows few animals on the place, look for receipts from pasture under miscellaneous receipts.

8. See if the rate of depreciation on buildings is consistent with the character of the buildings, as judged by their value.

9. Where new buildings or other improvements are constructed during the year care should be taken to see that the labor used in their construction is not included in the ordinary labor to perform the farm work.

10. Feed and supply inventory: The amount of feed on hand at the first inventory, plus the amount raised and the amount bought, less the amount on hand at the second inventory, should be consistent with the live stock kept to consume this feed. If there is no hay or corn in the first inventory, then some must be bought and should show in expenses. If the feed on hand at the beginning of the year is small, especially on dairy farms, some must be bought. If there is relatively a large amount on hand at the first inventory, the amount bought should be small.

In the case of seed for field crops, such as oats, if the amount for this year's seeding is included in the first inventory then the record should not show seed bought for the same crop during the year; or if it is so included it should not be charged as an expense, for this would make a double charge for this item. When a record does account for the item in both the first inventory and the expenses, the item of expense is usually found to be the amount the farmer has purchased for the following year's seeding, which item

should be accounted for in the second inventory, otherwise it makes a double charge. It is usually best to disregard the purchase item altogether.

The difference between wheat sold, plus wheat on hand at the second inventory, and the wheat produced, plus wheat on hand at the first inventory, should be a reasonable amount for seed and bread.

11. See if the price per acre of real estate is consistent with that of other farms in the locality.

12. On small farms the estimated value of the farmer's labor, if very small, would call for big labor expense; but if large, would call for small labor expense.

13. If a farmer has owned a farm a long time and has considerable mortgage, this is inconsistent with a high labor income; but a new farmer with a big mortgage may have a good labor income. If the farmer began as a laborer, then became a tenant, then an owner, and now has no mortgage, this is proof he has made good labor incomes in the past and should do so now if conditions on his farm are normal.

14. All calculations in a record should be checked to see that no errors have crept in. Thus, if the original data consisted of area and total quantity produced, all yields of crops are calculated. If the original data consisted of area and yield per acre, the total production is calculated. All these calculations should be checked to see that they are accurate. All additions and subtractions should be gone over for the same purpose.

15. Receipts from sources having no relation to the farm business should not be included in the farm receipts; but when part of the labor or equipment belonging strictly to the farm is used temporarily outside the farm, especially in the case of exchange labor, the receipts for such use are a part of the business. Equipment used continuously in other business except for short periods should not be included in the farm business, and when used on the farm the value for such use should be set down as an expense.

16. Records for individual farms which the comparisons suggested above show to be distinctly in error must either be corrected by securing more accurate data or they must be discarded. It is essential that a survey party should transfer the field record of each

farm to the office record sheet while the survey is in progress, so that additional data may be secured from any farm for which the record is incomplete or inaccurate.

Before commencing the tabulation of survey data the records should be rechecked by a competent person.

PRELIMINARY CALCULATIONS.

Before beginning the tabulation of the data from a farm management survey it is necessary to make calculations to obtain all the figures required in the tabulations. These calculations should be made, and the results recorded on each farm record sheet; or better, on a factor sheet prepared especially for the purpose. The calculations usually required for each farm are as follows:

1. Value of real estate per acre.
2. Depreciation, interest, and repairs—total for buildings, fences, and machinery, per farm and per crop acre.
3. Per cent of capital invested in each of the following factors of production: Land, dwelling, other buildings, implements and machinery, live stock, feed and supplies, and cash to run the farm.
4. Working capital, in dollars, and in per cent of total capital. (The working capital consists of the investment in implements and machinery, live stock, feed and supplies, and cash to run the farm.)
5. Working capital per acre of crops. (If the survey is in a region where pasture land is of prime importance and where the percentage of pasture land on the different farms varies widely, the pasture area should be reduced to its equivalent crop area and added to the crop area, making the crop area equivalent of the farm, and this calculation should be based on crop area equivalent. See method of determining crop area equivalent under calculation No. 55b.)
6. Pasture area percentage. That is, the percentage the pasture area is of crop and pasture area combined.
7. Percentage of total crop area devoted to each crop.
8. Crop index. This is determined for an individual farm as follows: Divide the quantity of each field crop produced on the farm by the average yield of that crop for all the farms in the sur-

vey; add the quotients together; divide by the total area of field crops on the farm in question.

9. Number of animals of each kind. This should be the average number of each kind of stock on hand at different times during the year. In the case of cows, horses, flocks of sheep, sows, and poultry the average of the first and second inventory is usually sufficient, except when some are raised and sold between dates of inventories. In the case of feeder steers or sheep the actual number fed should be given. When calculating the number of animal units for pigs that are raised and sold during the year, five such animals are usually considered an animal unit when the value indicates they had reached some 200 pounds or more per head in weight. If sold when the weight is much less than 200 pounds, 10 such animals are counted an animal unit.

10. Number of animal units for each kind of stock. An animal unit is the equivalent, from the standpoint of feed required, of a full-grown cow or horse. It is customary to count as an animal unit 2 head of young cattle or colts, 5 hogs, 10 pigs, 7 sheep, 14 lambs, or 100 poultry. In the case of feeder steers and feeder sheep the number of animal units calculated should be reduced in proportion to the time on feed as compared with the full year. Thus, 30 steers on hand six months will equal 15 animal units for the year.

11. Percentage of animal units of each class. That is, divide the number of animal units of each class by the total number of animal units on the farm.

12. Crop area and pasture area per animal unit. First, including work horses; second, excluding work horses.

13. Crop area and pasture area per cow. This calculation is important in dairy regions.

14. Total net receipts from each kind of animals except work horses.

15. Total net receipts from all kinds of animals except work horses.

16. Total net receipts per animal unit for each kind of animal except work horses.

17. Per cent of receipts from each enterprise for which there is a net plus receipt. (Ignore enterprises having minus incomes, as these are sources of expenditures, not receipts.)

18. Crop acres per man. (See calculation No. 30 for method of finding number of men.)

19. Crop acres per work horse (or mule).

20. Cost of man labor per crop acre. The cost of man labor here includes the value of hired labor, unpaid family labor, and the labor of the operator.

21. Monthly wages. To find this, divide the total value of man labor, as determined in the preceding paragraph, by the total months of man labor.

22. Number of work horses per man.

23. Value of machinery per crop acre.

24. Cost of dwelling per crop acre.

25. Cost of other buildings per crop acre.

(In surveys including farms on which pasture is very important, the last three calculations should be made on the basis of crop area equivalent instead of crop area. (See No. 55-b.))

26. Value of dwelling in terms of net farm income.

27. Value of other buildings in terms of net farm income.

28. Value of all labor other than the farmer's.

29. Value of all labor, including the farmer's.

30. Number of laborers. This is the total months of labor divided by 12.

31. Productive work units, both man and horse, on crops. (See Table I.)

32. Productive work units, both man and horse, on live stock. (See Table I.)

33. Productive work units, both man and horse, miscellaneous. (See Table I.)

34. Total productive man-work units.

35. Total productive horse-work units.

36. Percentage of productive man-work units on crops.

37. Percentage of productive man-work units on live stock.

38. Percentage of productive man-work units on miscellaneous.

39. Percentage of productive horse-work units on crops.

40. Percentage of productive horse-work units on live stock.
41. Percentage of productive horse-work units on miscellaneous.
42. Productive work units per man. This is the total productive man-work units divided by the number of laborers as determined in No. 30.
43. Number of productive horse-work units per horse.
44. Wages of operator per productive work unit. This is the labor income divided by the productive work units per man. It shows the operator's receipts for each productive work unit done by him.
45. Labor income per day. This is the labor income divided by 300, it being assumed that there are 300 work days in a year.
46. Per cent of income on capital, owner farms. First, without deducting value of owner's labor from farm income; second, making this deduction.
47. For tenant farms, determine the landlord's percentage of income on his investment and the tenant's percentage of income on his investment, if he has any.
48. Total value of feed produced.
49. Total value of feed purchased.
50. Total feed produced and purchased.
51. Total value of feed crops sold.
52. Total value of feed fed. This is the sum of the feed produced and purchased, and feed on hand at the beginning of the year, minus feed sold and feed on hand at the end of the year.
53. Value of feed fed per animal unit, including horses.
54. Value of feed purchased per animal unit, including horses.
55. Magnitude of business. A large number of the tabulations which should be made are intended to bring out the relation of magnitude of business to other factors. The magnitude of the farm business may be measured in any one of a number of different ways, depending upon the character of the farms included in the tabulations. Several of these measures of magnitude are discussed in the following paragraphs. The investigator should, after careful consideration of the character of his data, determine which of these measures will constitute the most accurate measure of magnitude of business and at the same time require the least work in

calculating, and should then use the measure thus determined upon unless for some special reason it is desirable to use some other measure in a particular tabulation. The following paragraphs state the conditions under which each of these measures may be used:

a. Size of farm in acres.—The size of the farm in acres may be used where the type of farming is similar on all the farms, or nearly all of them, provided the proportion of land occupied by timber and by land devoted to pasture does not vary widely from farm to farm. In other words, in a locality where the farms are quite uniform in character, with about the same proportion of crop land, pasture land, and timber land, and with similar intensity of livestock enterprises, the size of the farm is a satisfactory measure of the magnitude of the farm business. Where it can be used it is by far the simplest measure; but there are relatively few areas where such a measure is accurate.

b. Crop area equivalent.—Where the type of farming is similar on the different farms but the proportion of pasture land and of woodland is highly variable, a very accurate measure of magnitude of business is the sum of the crop area and the crop area equivalent of the pasture area, which sum we may call the crop area equivalent of the farm. It is applicable in all cases where the type of farming is of approximately similar degree of intensity on the different farms. In order to reduce the pasture area to its equivalent crop area we have the following considerations:

We may assume that 30 pounds of dry hay per day is the daily ration for a mature animal and that the number of acres of pasture required to carry one mature animal during the pasture season will furnish the equivalent of this much hay. Let C represent the acres of pasture required to furnish this much feed daily. If the pasture season is 5 months, or 150 days, long it must furnish during the season the equivalent of 150 times 30 pounds of hay, which is $2\frac{1}{4}$ tons. Let T represent the average yield of hay in tons per acre on the farm in question. We then have C acres of pasture furnishes the equivalent of $2\frac{1}{4}$ tons of hay; C acres of pasture are equivalent to $\frac{2\frac{1}{4}}{T}$ acres of hay; 1 acre of pasture is equivalent to $\frac{2\frac{1}{4}}{CT}$

acres of hay; P acres of pasture are equivalent to $\frac{2\frac{1}{4}P}{CT}$ acres of hay, where P is the total acres of pasture on the farm. Thus, to find the number of acres of hay to which the pasture on the farm is equivalent, multiply the number of acres of pasture by $2\frac{1}{4}$ and divide the product by the carrying capacity of the pasture (acres per animal) multiplied by the average yield of hay in tons per acre.

Even if it is necessary to estimate roughly the carrying capacity of the pasture, this measure of magnitude of the farm business will usually be more accurate than merely the number of acres in the farm.

c. **Days of productive labor.**—Unless there is a very great difference in the type of farming on the different farms to be tabulated, the total number of days of productive labor on the farm will be a fairly accurate measure of the magnitude of the business conducted on the farm. It is especially accurate where the relation of the capital invested to the amount of labor required is about the same on the different farms; but if on some of the farms there is a very large amount of capital with relatively little labor, as is the case on live-stock farms devoted largely to pasture, while on other farms there is an enormous amount of labor with very little invested capital, as is frequently the case in fruit and truck growing propositions, this measure of magnitude becomes quite inaccurate.

d. **Working capital.**—When the type of farming is similar, the total amount of working capital is a very good measure of magnitude of business. The working capital is the sum of the value of the live stock, machinery and tools, feed and supplies, and cash to run the farm. Its calculation has already been provided for in Preliminary calculations, No. 4.

e. **Cost of operation.**—The most accurate measure of the magnitude of the farm business is the cost of operation for the year. This consists of interest on capital, wages of the operator, current expenses, decrease in feed and supplies, and depreciation of buildings, fences, and equipment. That this is the most accurate measure of the magnitude of the business is shown by the fact that this sum is the greatest amount a farmer can lose in any one year, aside from the destruction of property by catastrophe. It should be calculated for every farm if comparisons involving factors depending on magnitude of business are to be made between groups of farms of distinctly different degrees of intensity. The only case in which it fails is that of a comparison between different localities in which the price of real estate differs greatly although the land is similar in productiveness; but such cases do not ordinarily arise in a single survey.

56. Measuring the magnitude of individual enterprises. It is ordinarily assumed that the net receipts from an enterprise constitute a measure of its magnitude. This would be true if the net receipts from each enterprise were always in proportion to the expense of operation, but unfortunately this is not always the case. Not infrequently a large enterprise produces a negative net income and small ones often do likewise. Since the quantity here under

discussion is only to be used in obtaining averages, it will seldom lead to wrong conclusions if these minus incomes be simply left out of consideration. (See calculation 17.) The difficulty can be completely overcome by using the total expense of conducting the enterprise, including interest on the required capital, as the measure of magnitude. It will seldom be practicable to do this; the possible error in the other method is too small to justify the use of this more laborious one in ordinary cases.

57. Index of diversity. There are several expressions which may be used for diversity of business. Each of them should be calculated for use in different tabulations.

a. In localities devoted quite largely to some form of live-stock farming the percentage of incomes from crops is one way of expressing diversity. This percentage should be calculated.

In regions devoted largely to crop farming the percentage of income from live-stock enterprises is similarly useful, though farming may be quite diversified on the basis of crops alone, as, in fact, it may be also on the basis of live stock. In crop-farming regions it is well to note the percentage of income from live-stock enterprises.

b. The number of enterprises producing more than 10 per cent of the farm receipts may also be used as a measure of diversity, except in cases of extreme diversity. It is possible for a highly diversified farm to have no enterprises producing as much as 10 per cent of the receipts.

c. In some cases diversity has been measured by giving the number of enterprises producing given incomes, as \$200, \$500, \$1,000, etc. This method is objectionable in that it does not distinguish between size of business and diversity of business. It leads to wrong conclusions because it attributes to diversity effects due to magnitude of business. The method should never be used. But if the income from each enterprise be expressed as a percentage of the total receipts of the farm this objection disappears. While it is of no value in studying the relation of diversity to efficiency in farming, since the expression for diversity is not a definite figure which can be used in tabulations, it is a useful method of presenting data to the farmer in farm management demonstration work. A good plan in such work is to classify the enterprises into groups producing 1-10, 10-20, 20-30, 30-40, 40-60, and over 60 per cent of the farm receipts. Two or three enterprises in the four higher groups and three or four in the two lower indicate a very satisfactory degree of diversity for most localities.

d. It is possible to get a definite figure to represent degree of diversity by a slight extension of the principle involved in the last method. When the magnitude of any one enterprise approaches 100 per cent of the magnitude of the farm business the business is approaching the status of single enterprise farming. Also, when all the enterprises are equal in magnitude the number of these enterprises is a measure of diversity. The highest possible degree of diversity consists of an indefinitely large number of indefinitely small enterprises. Then when any enterprise increases in magnitude it tends to reduce the degree of diversity of the business. If the magnitude of each enterprise be expressed in percentage of the magnitude of the farm business, and if each magnitude be weighted according to its distance from zero magnitude, then the sum of these weighted magnitudes divided into unity will give a definite figure which is a very accurate measure of diversity, and which is exceedingly useful in studying the effect of actual diversity on the efficiency of the business. Since the magnitude of an enterprise is also its distance from zero, the weighted magnitudes above mentioned are simply the squares of the individual magnitudes. Hence the following simple rule for calculating the degree of diversity of the farm business:

Diversity index: First express the magnitude of each enterprise in percentage of the sum of all these magnitudes;¹ square each of these percentages; find the sum of these squares; then divide unity by this sum.

All the above calculations are easily made on the slide rule, squaring numbers by means of the slide rule being an especially easy and rapid process. The percentages should be expressed decimally and carried to the third decimal place. Thus 15.5 per cent should be expressed as .155. The squares should be carried to the fourth decimal place. One decimal place is sufficient for the final result. Example:

Magnitudes of the enterprises.	The same in decimals.	Squares.
\$1,050	0.354	0.1253
750	.253	.0640
25	.008	.0001
875	.297	.0882
215	.073	.0053
45	.015	.0002
2,960	1.000	÷ .2831=3.5

¹ If receipts from an enterprise are used as the measure of its magnitude, ignore all enterprises showing minus net receipts.

This figure eliminates every other causal factor than diversity, and hence may be safely used in tabulations designed to bring out the effect of diversity on the efficiency of the farm business.

58. Adjusted labor income. In the older settled portions of the country magnitude of business is perhaps the most important factor in the success of the farmer. This means that, in the majority of cases, it has more influence on labor income than any other factor. This being the case, it is difficult to bring out the effect of other factors unless the number of farm records is sufficiently large to insure the elimination of the effect of magnitude of business by the law of averages, or to permit grouping the farms first on magnitude of business and then subdividing each group on the basis of the factor to be studied. In any case, the law of averages will not eliminate the effect of magnitude of business if the factor to be studied itself depends on magnitude of business.¹ This difficulty may be obviated as follows: First group the farms on the basis of magnitude of business, making the limits of the groups as small as possible and still have enough farms (50 to 100 if possible) to give a reliable average for the labor income in each group; then express the labor income of each farm in percentage of the average labor income of its size group. We may call this percentage the "adjusted labor income." It is a measure of success in farming as affected by factors other than magnitude of business. Thus if the labor income of a 50-acre farm is 80 per cent of the average for its group, and that of a 125-acre farm is 80 per cent of the average for its group, these two farms are considered to be equally efficient, though the larger farm may have much the larger labor income.

This adjusted labor income should be calculated for each farm and recorded on the survey record sheet, or the special factor card if there is one. It is especially useful in dealing with factors which are influenced by size of farm. Thus, in studying the relation between type of tenure and labor income, we are confronted with the difficulty that in some localities, especially in the Northern

¹ The law of averages, which plays so important a part in the study of farm management survey data, may be briefly stated as follows: In cases where variations from a normal are just as liable to be plus as minus, the plus and minus variations will cancel each other if the number of cases averaged is large.

States, tenant farms are usually somewhat larger, on the average, than owner farms, while share tenant farms are larger than cash tenant farms. In order to get at the real influence of type of tenure we must therefore eliminate the effect of size of farm. This may be done by using the adjusted labor income. If the number of farms in the survey were large enough the same thing could be accomplished by dealing only with farms of approximately the same magnitude of business. Again, the number of productive work units per man varies with size of farm, at least on small farms. We can eliminate the influence of size of farm and study directly the effect of number of work units per man on labor income by using the adjusted labor income. The proportion of feed bought also depends on size of farm; but if we use the adjusted labor income instead of the actual labor income of each farm, we are able to study the effect on labor income of the percentage of feed bought. Many other illustrations might be given of the usefulness of this adjustment.

Even when the factor the influence of which is to be studied has no relation to size of farm, such, for instance, as the effect of percentage of receipts from dairy products on labor income, we must depend on the law of averages to eliminate the fluctuations in labor income due to differences in magnitude of business. If the number of farms in each group to be averaged is quite large this will occur, but if the number is not large the elimination may not occur.

The use of the adjusted labor income in such cases removes this difficulty and permits the use of a smaller number of farms in each group than would otherwise be permissible. That is, it renders the work more accurate.

It is evident that unless the survey includes several hundred farms it is not advisable to adjust labor income in this manner, because there would be too few farms in each size group to give a reliable average labor income for each group. But when the adjusted labor income has once been obtained, reliable averages can then be obtained from smaller groups of farms than before, for the most important fluctuation in labor income has then been eliminated.

TABLE I.—*List of productive work units¹ per acre of the various crops and per animal unit for the various classes of live stock, for Chester County, Pa. The figures will vary more or less for different localities. The figures used should be based on average local practice.*

Productive work units per acre of crops:		
	Man.	Horse.
Corn for grain.....	7	6
Corn for silage.....	6.5	7
Potatoes.....	10	9
Tobacco.....	20	7
Wheat, oats, or other grain, oat hay, millet, peas, and other forage.....	2	3
Hay.....	1	1
Alfalfa (two cuttings).....	3	3
Sweet corn (commercial).....	10	9
Truck (commercial).....	24	9
Truck (home use).....	12	4.5
Fruit (commercial when sales amount to \$25 or more per acre).....	10	5
Fruit (home use).....	5	1
Fruit (not bearing).....	2.5	0.5
Productive work units per head of live stock:		
Dairy cows.....	17	2.5
Dairy cows (pure bred).....	20	2.5
20 veal calves.....	20	1
10 heifers and calves.....	30	1
10 heifers and calves (pure bred).....	40	1
1 bull.....	7	.....
20 steers (for entire year).....	30	1
10 colts or horses (not worked).....	60	1
100 breeding ewes.....	50	3
100 other sheep.....	40	3
10 brood sows.....	35	5
50 other hogs.....	30	5
100 hens or other poultry.....	18	2
200 chickens or other poultry (raised).....	18	2

¹ A work unit is an average day's work.

Productive work units per \$1 of outside labor:	Man.	Horse.
Outside labor, man and team.....	0.2	0.4
Outside labor, man only.....	0.4	.....
Outside labor, marketing (man and horse).....	0.2 $\frac{2}{3}$	0.2 $\frac{2}{3}$

PRINCIPLES OF TABULATION.

The interpretation of farm management survey data consists in the main of the discovery and measurement of causal relations between the various classes of facts contained in the data. In research work in general such causal relations are studied by producing changes in one class of phenomena and observing the resulting changes in others. In farm management survey data the variations to be studied are already at hand, the problem being to arrange the data in such manner as to display the variations of one factor and then note the variation in others supposed to depend in some way on it.

A farm management survey record consists of the various items constituting an analysis of the farm business. It is the interdependence of these various items that is to be studied. The general problem is to find what relation exists between the magnitude of the various items and the efficiency of the farming. Farm management studies have shown that success in farming depends largely on the following factors: (1) Type of land tenure; (2) type of farming; (3) magnitude of business; and (4) the various factors of efficiency, such as yield per acre, income per cow, adequacy and economy of equipment, diversity of business, productive work units per man and per horse, etc.

In any particular case the problem is to discover the relation of the above factors to success in farming under the conditions which prevail in the locality to which the data relate.

Consideration of a particular case will best serve to show the principles involved in a study of causal relations. The relation between size of farm and labor income may be used for this purpose.

Two methods of procedure present themselves. First, we may arrange the farms in groups according to increasing size of farm and find the corresponding variations in the average labor income

of each group; or, second, we may arrange them in groups according to ascending labor income and find the corresponding variations in the average size of farm in each of the labor income groups. It is highly important that a proper decision be made as to which of these methods to use. In order to show the difference in the results obtained by the two methods a number of farms are grouped in Table II-A according to size of farm, while in Table II-B the same farms are grouped according to labor income.

TABLE II-A.—*Farms grouped by size, and the resulting average labor incomes determined.*

	Size groups.					
	20-40	41-60	61-80	81-100	101-120	121+
Average labor income.....	\$117	\$235	\$359	\$447	\$592	\$715

TABLE II-B.—*The same farms grouped by labor income, and the resulting average size of farm determined.*

	Labor income groups.						
	-\$1,000 to -\$501	-\$500 to 0	\$1 to \$500	\$501 to \$1,000	\$1,001 to \$1,500	\$1,501 to \$2,000	\$2,001 up.
Average sizes.....	114	56	56	94	107	120	130

Table II-A shows a gradual and regular increase in labor income as size of farm increases. Table II-B, indeed, shows some kind of relation, but the results are plainly distorted by the effect of some other factor or factors. Evidently the relation sought is more clearly and simply portrayed in the first tabulation than in the second. The cause of the difference in results in these two tabulations is at the bottom of all sound reasoning about farm management data. Unless this cause is clearly apprehended serious errors are liable to occur in interpreting such data.

CAUSE OF THE IRREGULARITY IN TABLE II-B.

Labor income is the combined result of all the factors of success mentioned a few pages back. One of these factors is magnitude of business, in which the size of the farm is an element. Hence, in these two tables we are studying the relation between one of the elements of magnitude of business on the one hand and the combined effect of all the factors of success on the other.

In Table II-A the farms are arranged to display the variations in size of farm; the last line of the table shows the resulting variations in labor income. The question arises whether these variations in labor income are due entirely to variations in size of farm.

We may assume that variation in size of farm causes variations in labor income, but what has become of the influence on labor income of tenure, type of farming, and the various factors of efficiency that the variations in the table should be wholly due to size of farm? Let us study each of these factors separately.

Type of tenure.—Since the type of tenure is more or less related to size of farm, when a number of farms are grouped on size the various forms of tenure do not distribute themselves at random in the various size groups; tenant laborer farms will generally be found in the groups of smaller farms, share tenant farms in the groups of larger farms, etc. Now the form of tenure has some effect on labor income. Hence variations in labor income due to difference in form of tenure are not eliminated, since they are not alike in each size group. In Table II-A this difficulty has been overcome by using only farms of the same type of tenure. This is, in general, the way of getting around this particular difficulty. If desired, a similar study can be made of each type of tenure.

Type of farming.—There is more or less tendency for small farms to be devoted to the more intensive types of farming and large farms to the more extensive. Also, the more intensive the type, the higher the labor income on the average for farms of similar size. Therefore, unless the farms in each group are similar in degree of intensiveness, the difference will tend to make the labor income higher in the groups of small farms and lower in the others. This difficulty was here overcome by using in both these tables only farms of approximately the same type. This would not have been

necessary if we had been using "cost of operation" instead of "size of farm."

Factors of efficiency.—Let us first consider yield of crops per acre. Previous studies have shown that the average yield per acre of a given crop is just about the same on farms of all sizes. This being the case, both high yields and low yields will occur with about the same relative frequency in all the size groups, so that the average yield will be about the same in each group. Hence the average labor income in the various size groups will not be affected by variation in yield. The effect of such variations is canceled by the law of averages.

Approximately the same is true of all the other factors of efficiency, except in so far as they depend on size of farm, and in the latter case, what influence they have on labor income is in reality due to size of farm. Thus it costs more per acre to equip a small farm than a large one, and this makes the expense of operating a small farm relatively greater than that of a large one. Hence labor income is relatively smaller on small farms than on large ones. But this is just the kind of effects we are trying to measure. Table II-A thus gives a clear presentation of the effect of size of farm on labor income.

In Table II-B the farms are classified according to labor income and averaged on size. Now labor income is the combined effect of many causes. Let us see if the various causes cancel out in the averages as did the effects of these causes in the previous table.

As previously stated, variation in intensiveness of farming was completely eliminated at the outset by considering only farms that were comparable in type, so that we need not consider this factor further. The same is true of difference in form of tenure.

When the farms were grouped by size, factors of efficiency (yield, income per cow, etc.) canceled out, because their effects are proportional to size of farm, and unusual gains and unusual losses were brought together in the same groups. But in Table II-B they are thrown into different classes, because the unusually large gains, which occur only on large farms, are found in the groups of large labor incomes, while the unusually large losses, which are also found only on large farms, are found in the minus

labor income groups. They thus have no chance to cancel each other. In fact the largest minus labor income group is made up almost wholly of large farms, the average of this group being the third largest in the series. The irregularity in the size averages of Table II-B is thus due to the fact that the basis of sorting did not eliminate all the causes other than the one we were investigating.

It will be noticed that in Table II-A the basis of grouping is a causal factor, that is, variation in size of farms causes a corresponding variation in average labor income; while in Table II-B the basis of grouping is a resultant, or effect, in this case of many causal factors. Grouping on a cause gave a consistent result, because the effects of other causes could be eliminated, while grouping on an effect gave a result that is hard to interpret because influences not under investigation could not be eliminated. This divergence is the usual result of these two methods of grouping. The beginner in farm management investigations should never group his farms on the basis of an effect; the grouping should always be on the basis of a cause, and the averaging is then done on an effect.

When the relation between a cause and the combined effect of several causes, including the one in question, is not complicated by any causal relation of both the cause and the combined effect to some other causal factor, the variation in the averages of the various groups of a tabulation will be due entirely to the variations of the cause under investigation, and the table will display the true effect of this cause.

If the effect under consideration is not the combined effect of two or more causes, but is solely the effect of the one cause under consideration, then it is a matter of no consequence which method of grouping be used—that of Table II-A or that of Table II-B. Suppose, for instance, that size of farm were the sole determining factor in the matter of labor income; in such a case the labor income of every farm would be directly proportional to its size, and grouping on either size of farm or labor income would throw exactly the same farms into each of the groups. But such simple relations are seldom found in farm management survey data.

To show how the influence of one causal factor may sometimes be deduced from the combined effect of this factor and another which can not be separated from it, let us consider the combined

effect of percentage of intertilled crops and number of animal units per hundred acres of crops on the crop index of a number of farms, as worked out by Mr. D. A. Brodie, of this office, in his study of the relation of farm practice to soil fertility.

Table III shows this relation for a group of farms in Chester County, Pa. A correlation exists here between percentage of intertilled crops and number of animal units per hundred acres of crops, for the reason that the more heavily stocked a farm is in this locality, the larger its percentage of corn area. The live-stock population is thus a causal factor in the percentage area of intertilled crops.

TABLE III.—*Influence of area of intertilled crops and animal units on crop yield in Chester County, Pa.*

Number of farms.	Per cent of cultivated area in intertilled crops.	Average per cent of area in intertilled crops.	Animal units per 100 acres.	Crop index.
72.....	Less than 25.....	20.8	37.6	96
58.....	25-30.....	27.4	41.2	100
54.....	30-35.....	32.7	48.4	105
37.....	35 and over.....	41.4	53.4	105

The table shows that as the percentage of intertilled crops increases the crop index increases up to a certain point, but beyond this point there is apparently a falling off. It also shows that the number of animal units per hundred acres of crops increases regularly with increase in percentage of tilled crop area. The farms were here grouped on percentage of intertilled crop area, a resultant factor so far as number of animal units per given area is concerned; but no difficulty is thus introduced for the reason that no other causal relation exists to complicate matters, so that the results are practically the same as if the number of animal units per hundred acres of crops had been used as the basis of classification.

If the number of animals per hundred acres of crops did not continue proportional to percentage of tilled crop area this table would offer no conclusive evidence as to the action of either of these two

causes separately; but as it is the results appear to be significant. We may assume that the crop index would increase as the amount of manure used increases within very wide limits if no disturbing factor enters. But in this case the maximum yield appears to be reached at a certain point, although the amount of manure used still increases beyond that point.

It is known that summer tillage has some tendency to promote oxidation of organic matter in the soil, and thus to destroy humus and set free nitrates in the soil. The oftener the land is put into a tilled crop the greater this influence should be. Finally we reach a point where oxidation is so rapid as to reduce the amount of organic matter in the soil more rapidly than it is being added, in spite of the fact that more organic matter is added than before, and the crop index thus begins to fall. Unfortunately the variation in percentage of intertilled crops stops just at the point where it would be most interesting to know what the next few terms of the series would be. However, we may tentatively conclude that when the percentage of intertilled land increases beyond about 37 per cent in the locality in question the tillage tends to lower the crop index, while up to that point its influence is not deducible from these data because whatever influence tillage exerts is complicated by the influence of intensity of stocking. Presumably the two influences are similar up to 37 per cent of tilled crop area.

Fortunately, a survey of farms on the black prairie lands of Illinois supplies the missing terms of the series of crop index averages in Table III. The data for the Illinois farms are given in Table IV.

TABLE IV.—*Influence of area of intertilled crops and animal units on crop yield in Marshall silt loam—Illinois.*

Number of farms.	Per cent of cultivated area in corn.	Average per cent.	Animal units per 100 acres.	Crop index.
75.....	Less than 37.5.....	28.4	19.3	102
72.....	37.6-48.9.....	43.3	18.1	103
82.....	49-59.9.....	53.9	17.7	100
74.....	60 and over.....	73.6	15.8	93

The small size of the Pennsylvania farms makes rather intensive farming necessary there, so that the large herds of dairy cows kept must be fed mainly from field crops. As corn produces more feed per acre than any other crop commonly grown in that region, the acreage of corn increases as the live stock increase in numbers. In the Illinois locality, on the other hand, the area of corn increases as live stock decrease in numbers, the corn being grown for sale. It is also important to notice that the variation in intensity of stocking is very slight in Illinois in the groups based on tilled crop area, so that difference in the amount of manure available has less influence here than in Table III. In the first two columns of Table IV we find the crop index increasing and the intensity of stocking slightly on the decrease as the tilled crop area increases. Beyond a point between 28.4 and 43.3 per cent of tilled area both decrease as tilled crop area increases. In this case the influence of tillage seems to be more important than that of the animals kept for the crop index increases in spite of decreasing live stock up to the point at which we may assume that tillage becomes excessive, beyond which humus appears to be burned up too fast and the crop index falls off.

Apparently in both these tables the optimum percentage of intertilled crops is about the same, and is in the vicinity of 35 to 40 per cent.

In the above illustration we are able to evaluate the factor of tillage although its results are mixed up with the results of variation in the amount of available manure, for the reasons (1) that the effect of the manure is known in advance and can thus be discounted; (2) the effect of the two factors is not the same throughout the series of averages. The same result could be arrived at by comparing only farms with the same intensity of stocking, but on account of the relation between number of animals and area of corn it would require a very large number of farms to render this possible.

Recapitulation.—In studying the relation between two factors, the variation of one of which is supposed to be a direct cause of variations in the other, the farms should always be grouped on the basis of the *causal* factor and each group averaged on the basis of the *resultant* factor. If each of two factors bears a causal relation

to a given resultant, while at the same time one of them bears a causal relation to the other, unless the effect of one of them is entirely known it is necessary to devise some means of eliminating the effect of one of them before the effect of the other can be determined. When the number of farms is sufficiently large the effect of one of two related causal factors may sometimes be eliminated by limiting the investigation to farms on which there is little or no variation in that factor. Thus, in studying the relation of size of farm to labor income, the confusing influence of size of farm on intensity of the type of farming may be eliminated by confining the study to types of farming comparable in intensiveness.

CLASSIFICATION BY TENURE.

Before undertaking comparative studies of a group of farms they must be separated into classes in which all farms in each class are comparable. The first separation should be based on tenure, and may include the following classes:

1. Plantations (to be considered elsewhere).
2. Manager farms; those operated by a hired manager.
3. Working owner farms; those operated by owners who take the part of a working manager without salary.
4. Nonworking owner farms; those operated by owners who direct but take no part in the work of the farm.
5. Owner and landlord farms; those, part of which is operated by the owner, the remainder being rented out.
6. Owner and tenant farms; those operated as in (3), but of which the operator owns only part of the land, holding the remainder as a tenant.
7. Cash tenant farms; farms rented for cash and operated by the tenant as a working manager without salary, the working capital being furnished by the tenant.
8. Share tenant farms; those operated as in (7), but with rent consisting of a share of the proceeds.
9. Tenant laborer (or cropper) farms; tenant farms on which the tenant furnishes little or none of the working capital.
10. Combined tenant farms; two or more farms operated by one tenant, but rented from different landlords, or on a different basis.

The above list is only suggestive. Various modifications of these classes occur. The classification used should conform to the facts concerning the farms to be classified.

In certain kinds of tabulation all the foregoing classes, with the exception of plantations, may be disregarded if each farm is first reduced to the basis of class 3. This may be done as follows:

Class 2. Manager farms. Deduct from expenses, and add to farm income and labor income, the salary of the manager. This applies whether the manager takes part in the farm work or merely directs it.

Class 4. Nonworking owner farms. Deduct from expenses, and add to farm income and labor income, the wages of one man for the part of the year when hired labor is employed.

Class 5. Owner and landlord farms. Eliminate from the investment the portion of the farm rented out, and eliminate from the records all items relating to this portion of the farm. This includes a proportionate share of taxes and other general farm expenses in which the land rented out should share and all receipts from and expenses for this part of the farm.

Classes 6-10. Tenant farms of all kinds. Consider landlord and tenant as one person, and eliminate all transactions between them.

The above reductions are necessary only in tabulations that involve items that would be changed in making the reduction.

TABULATIONS SUGGESTED.

The following list of tabulations is suggested as a means of bringing out the relations between the various elements of farm management survey data and of showing the application of farm management principles to the agriculture of the locality in which the survey is made. The list is merely suggestive; in many cases some of the tables will give no significant result, and often other tabulations will be required.

In addition to the averages noted in the list of tabulations which follow (right-hand column), each tabulation should show:

A. The number of farms in each group (and also in each subgroup if the main groups are further subdivided).

B. Where the basis of grouping is quantitative (as crop area, number of animal units, etc.) and not qualitative (as types of tenure, type of farming, etc.), the average of each group (and subgroup if any) for the basis of grouping should be given. Thus, if the farms are divided into groups based on number of animal units per 100 acres of crop, the average number of animal units per 100 acres of crops in each group should be given.

C. A summary of all the columns or lines, as the case may be (both columns and lines if each group is divided into subgroups).

In dividing farms into groups on the basis of a quantitative factor, as crop area, percentage of income from poultry, etc., where possible make the size limits of the various groups such as to give a sufficient number of farms in each group to give a reliable average, at least in most of the groups (all groups if practicable to do so).

When the farms have been sorted on any factor, the calculations should be made for all the tables requiring this same sorting. The various groupings to be made, with the numbers of the tabulations (see pp. 30 to 40) required in each, are as follows:

1. Tabulations requiring no sorting into groups: V,¹ XIII,¹ XXXI, LXXI, LXXIII, LXXIV, LXXV.

2. Types of tenure: I, III, IV, VI, VII, XIV, XX, XXI, XXIII, XXIV, LXI, LXVII, LXIX.

3. Size of farm: II.

4. Crop area equivalent: VIII, IX, XV, XXII, XXV, XXVI, XXXVI, XXXVII, XXXVIII, XXXIX, XL, XLI, XLII, XLV, XLVI, XLVII, XLVIII, XLIX, LVI, LXII, LXVIII.

5. Types of farming: X, XI, XVII, XVIII, XXXII, XXXIV, L, LI, LII, LIII, LXVI, LXX.

6. Percentage of crop area devoted to each crop: XII, XXVII.

7. Percentage of animal units of each kind: XIX.

8. Percentage of receipts from each source: XXVIII.

9. Types of dairying—exclusive: XXIX.

10. Types of dairying—inclusive: XXX.

11. Crop acres per animal unit: XXXIII.

¹ Tabulations V and XIII may be made by summarizing the results of other tabulations, as noted later.

12. Magnitude of business: XXXV.
13. Productive work units per man: XLIII, LX.
14. Crop area per farm: XLIV.
15. Animal units per 100 acres of crops: XVI, LIV, LXXII.
16. Percentage of intertilled crops: LV.
17. Crop index: LVII, LIX.
18. Income per cow: LVIII.
19. Diversity index: LXIII.
20. Percentage of receipts from crops: LXIV.
21. Rotations followed: LXV.

Tabulations designed to bring out the significant relations in farm management survey data.

	Tabulation No.	Basis of grouping.	Basis of averages.
PRELIMINARY TABULATIONS.	I	Types of tenure...	Size of farms, tillable area, crop area, tillable pasture area, other pasture area, woodland, waste land, value of real estate per acre, per cent of crop and pasture area in pasture.
	II	Size of farms.....	Same as in Table I.
	III	Types of tenure...	Labor income and adjusted labor income of farm as a whole; of tenant; per cent over \$1,000. (For farm as a whole, reduce to basis of working owner.)
	IV	.....do.....	Owner farms; per cent of income on investment (see calculation 46, p. 11). Tenant farms; landlord's per cent income on investment; tenant's per cent income on investment. (See calculation 47, p. 11.)

Tabulations designed to bring out the significant relations in farm management survey data—Continued.

	Tabulation No.	Basis of grouping.	Basis of averages.
TYPES OF FARMING. Crops.....	V	Farms of all sizes and tenures; no division into groups.	Per cent of total crop area devoted to each crop. This may be obtained by summarizing Table VI or Table VII. Similar data from recent censuses to show whether the survey data is representative of the country as a whole and whether each crop is gaining or losing in importance or merely holding its own.
	VI	Types of tenure...	Acres of each crop and of pasture; per farm reporting and per farm, all farms.
	VII	.....do.....	Percentage of crop area devoted to each crop, per farm reporting, per farm, all farms. Percentage pasture area is of crop and pasture area.
	VIII	Magnitude of business.	Same as in VI.
	IX	.....do.....	Same as in VII.
	X	Types of farming, if there are marked differences in type.	Acres of each crop per farm.
	XI	.....do.....	Percentage of crop area devoted to each crop.
	XII	Percentage of crop area devoted to each crop. Regroup for each crop and devote one line of table to each crop. Make percentage classes of suitable size to display true character of variation in percentage area of each crop. Unimportant crops require small percentage classes.	Number of farms in each percentage group. This may also be displayed in a dot chart, each dot representing the percentage of area devoted to a particular crop on one farm. This table (or chart) shows the variations in percentage area of each crop. It may be confined to only one or two leading types of tenure. Summary columns should be given showing number of farms having 1-100, 20-100, and 40-100 per cent of their area devoted to each crop.

Tabulations designed to bring out the significant relations in farm management survey data—Continued.

	Tabulation No.	Basis of grouping.	Basis of averages.
TYPES OF FARMING—contd.	XIII	Farms of all sizes and tenures; no division into groups.	Number of animals of each class per farm; same reduced to animal units; the latter reduced to percentage of total animal units per farm; similar census data (number of animals only) from several recent censuses; may be obtained by summarizing Table XIV.
	XIV	Types of tenure...	Same as first three columns of XIII.
	XV	Magnitude of business.	Percentage of animal units for each kind of animal; this may also be shown by dot chart. (See XII.)
	XVI	Animal units per 100 acres of crops.	Percentage area of each crop; also percentage of crop and pasture area in pasture.
	XVII	Type of farming, if of importance.	Number of animals of each kind per farm.
	XVIII	.....do.....	Percentage of animal units of each kind per farm.
	XIX	Percentage of animal units of each kind in total per farm. (See XII.)	Number of farms in each percentage group.
	XX	Types of tenure...	Crop acres and pasture acres per animal unit.
	XXI	.....do.....	Crop acres and pasture acres per dairy cow.
	XXII	Magnitude of business.	Number of animal units of each kind per 100 acres of crops per farm.
Live stock	XXIII	Types of tenure...	Actual income from each enterprise per farm.
	XXIV	.....do.....	Percentage of income from each enterprise (and census data).
	XXV	Magnitude of business.	Same as XXIII. May tabulate each tenure separately or all together or only leading tenure. Graph for all sizes.
	XXVI	.....do.....	Same as XXIV. (See note on tenure under XXV.)
	¹ XXVII	Percentage of crop area devoted to corn. (Use only farms of comparable types of farming.)	Labor income and adjusted labor income. If different tenures are used, reduce to bases of working owners.
Sources of income.			

¹ Prepare tables like XXVII for each crop, and like XXVIII for each source of income.

Tabulations designed to bring out the significant relations in farm management survey data—Continued.

	Tabulation No.	Basis of grouping.	Basis of averages.
TYPES OF FARMING—contd.	XXVIII	Percentage of receipts from sale of corn. (See XXVII.)	Same as XXVII.
	XXIX	Types of dairying, each group to consist only of farms selling only the one dairy product.	Size of farm; distance to market point; number of cows; labor income and adjusted labor income. Percentage of total dairy farms in each group.
	XXX	Types of dairying, each group to consist of all farms selling a given product. This will throw some farms into more than one class.	Same as in last. (In this table the per cents will usually add up over 100 because some farms occur in 2 or more groups.)
	XXXI	List of enterprises, with conditions favorable and unfavorable to each.	(See Table XXV, Dept. Bul. 341.)
Sources of income	XXXII	Type of farming. (Use only farms of same tenure in one table. If several tenures are important, tabulate each separately.)	Size of farm.
	XXXIII	Crop acres per animal unit (all kinds together). Subdivide each group on basis of percentage of dairy cows in total animal units. Run primary groups at left margin; secondary as column headings.	Percentage of productive work units on crops.
	XXXIV	Type of farming...	Same as XXXIII.

¹ Prepare tables like XXVII for each crop, and like XXVIII for each source of income.

Tabulations designed to bring out the significant relations in farm management survey data—Continued.

	Tabulation No.	Basis of grouping.	Basis of averages.
MAGNITUDE OF BUSINESS. (See Preliminary calculation No. 55.)	XXXV	Magnitude of business.	Labor income. (If different tenures are combined, reduce all to basis of working owners.) Graph—Magnitude as horizontal measure, labor income vertical measure; this graph is a line or curve, rising as magnitude increases. (See fig. 4, Dept. Bul. No. 41.) Graph—Showing labor income of each farm, the farms arranged in order according to magnitude of business. (See fig. 9, Dept. Bul. 341.)
	XXXVI	.....do.....	Productive man work units; crop acres per man; same per work horse; cost of total man labor per crop acre; monthly wages; work horses per man; value of machinery per crop acre.
	XXXVII	Magnitude of business. Subdivided by tenure.	Two columns for each tenure; one for cost of dwelling and the other for cost of other farm buildings.
	XXXVIII	Magnitude of business; using only working owners.	Same as XXXVII, expressing cost in terms of farm income.
	XXXIX	Magnitude of business; using only cash tenants.	Same as XXXVII, expressing cost in terms of tenants' farm income.
	XL	Magnitude of business; using only share tenants with working capital.	Do.
	XLI	Magnitude of business; using only tenant laborers (croppers).	Do.
	XLII	Magnitude of business.	Cost of depreciation, interest, and repairs on buildings, fences, and machinery; totals per farm and per crop acre.
	XLIII	Number of productive work units (man) per farm.	Labor income. Graph for same. (See XXV.)
	XLIV	Crop area per farm.	Give percentage of farms in each size group (based on crop area) owning each of principal items of field machinery. Use list of items as left margin; crop area groups as column headings.

Tabulations designed to bring out the significant relations in farm management survey data—Continued.

	Tabulation No.	Basis of grouping.	Basis of averages.
MAGNITUDE OF BUSINESS—con.	XLV	Magnitude of business. (Use working owner farms, or other leading tenure, as basis of grouping on size. Other tenures may be added without grouping on size).	Capital, in dollars; percentage of capital invested in land, dwelling, other buildings, implements and machinery, live stock, feed, and supplies, and cash to run the farm; percentage of working capital; working capital per acre of crop area equivalent.
	XLVI	Magnitude of business (cash tenants only).	Percentage of income on landlord's capital.
	XLVII	Magnitude of business; using share tenants with working capital.	Do.
	XLVIII	Magnitude of business; using tenant laborers (croppers).	Do.
	XLIX	Magnitude of business.	Percentage of farms of each tenure in each size group.
	L	Type of farming, subdivided on magnitude of business.	Labor income. This tabulation is not feasible unless large numbers of farms are available. With smaller numbers, omit the subdivisions on size and use labor income adjusted for magnitude of business.
	LI	.....do.....	Total capital.
	LII	.....do.....	Working capital per acre.
	LIII	.....do.....	Total labor.
QUALITY OF BUSINESS.	LIV	Intensity of stocking (animal units per 100 acres of crops. If percentage of pasture area is highly variable, use crop area equivalent).	Crop index; yield per acre of each crop.
	LV	Percentage of intertilled crops.	Do.
	LVI	Magnitude of business.	Do.
	LVII	Crop index.....	Labor income. (Use adjusted labor income if number of farms is small.)
	LVIII	Income per cow...	Do.

Tabulations designed to bring out the significant relations in farm management survey data—Continued.

	Tabulation No.	Basis of grouping.	Basis of averages.
QUALITY OF BUSINESS—contd.	LIX	Crop index; subdivide on income per cow.	Labor income. (Use adjusted labor incomes if number of farms is small.)
	LX	Productive work units per man.	Size of farm; productive work units per horse; labor income; adjusted labor income; receipts per cow; wages of operator per day (labor income divided by productive work units per man); labor income per day for 300-day year (labor income divided by 300).
	LXI	Types of tenure...	Yield per acre, each crop; crop index.
FARM ORGANIZATION.	LXII	Magnitude of business.	Diversity index.
	LXIII	Diversity index...	Labor income; adjusted labor income.
	LXIV	Percentage of receipts from crops.	Do.
	LXV	Tabulate the principal rotations, record number of farms using each, average size of these farms, and numbers of animal units of each kind per 100 acres of crops.	
	LXVI	Types of farming..	Percentage of receipts required for operating expenses.
	LXVII	Types of tenure...	Do.
	LXVIII	Magnitude of business.	Percentage of expenses for each item of expense.
	LXIX	Types of tenure...	Do.
	LXX	Types of farming..	Do.
	LXXI	Cost of feed per animal unit and income per animal unit other than work horses. (See Table V, attached, for illustration.)	
	LXXII	Value of manure per animal unit. (See Table VI, attached, for illustration.)	
	LXXIII	Acres of feedable crops and of pasture per animal unit. (See Table VII, attached, for illustration.)	
	LXXIV	Rate of depreciation of dairy cows. (See Table VIII, attached, for illustration.)	
	LXXV	Rate of depreciation of farm work horses. (See Table IX, attached, for illustration.)	

MODELS FOR TABULATIONS LXXI TO LXXV.

TABLE V (Tabulation LXXI).—*Feed cost per animal unit on 378 farms operated by owners; Chester County, Pa.*

	Amount raised.	Amount sold.	Amount con- sumed.	Price.	Value of feed con- sumed.
	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushel.</i>	
Corn for grain and other.....	265,313	25,788	239,525	\$0.75	\$179,644
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Ton.</i>	
Silage.....	6,678		6,678	4.00	26,712
Hay.....	12,481	5,642	6,839	18.00	123,102
	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushels.</i>	<i>Bushel.</i>	
Oats.....	54,360	2,725	51,635	0.50	25,818
Rye.....	224	52	172	.80	138
Barley.....	220		229	.75	172
Oats and speltz.....	160		160	.60	96
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Ton.</i>	
Straw ¹	5,000	900	4,100	4.00	16,400
Stover ¹	6,000		6,000	5.00	30,000

¹Yield estimated.

Total value of farm feed.....	\$402,082.00
Increase in inventory value.....	36,061.00
Total value of farm feed consumed.....	366,021.00
Total value of farm feed consumed per animal unit.....	49.79
Value of feed purchased.....	74,304.00
Value of feed purchased per animal unit.....	10.11
Total feed cost.....	440,325.00
Total feed cost per animal unit.....	59.90

TABLE VI (Tabulation LXXII).—*Value of manure per animal unit determined by comparing two groups of Chester County, Pa., farms.*

[The first group contains 94 farms (one-fourth of entire number) having the least number of animal units per 100 acres of crops (average, 20.36). The second group includes 94 farms having the highest number of animal units per 100 acres of crops (average, 56.85). Difference, 36.49 animal units—378 owner farms, Chester County, Pa.]

Crops.	Corn.	Potatoes.	Wheat.	Oats.	Hay.
Acres per 100 acres of crops ¹	23.00	6.21	18.8	6.6	45.4
Average yield per acre (bushels or tons):					
Lowest group, 94 farms.....	59.98	79.18	23.90	37.86	1.22
Highest group, 94 farms.....	71.83	83.09	25.56	43.67	1.55
Increase in yield per acre (bushels or tons).....	11.85	3.91	1.66	5.81	.33
Increase in production per 100 acres of crops (bushels or tons).....	272.55	24.24	31.21	38.35	14.98
Prices ¹	\$0.80	\$1.04	\$0.92	\$0.55	\$22.12
Value of increased production per 100 acres of crops.....	\$218.04	\$25.21	\$28.71	\$21.09	\$331.36

¹ Areas and prices are the averages for the entire 378 farms operated by their owners. These are used in order to eliminate factors other than the quantity of manure available. The crop areas given here are per 100 acres of the five crops mentioned.

Total of last line.....	624.41
Excess of fertilizer used by second group, per 100 acres of all crops.....	48.00
Increase due to 36.49 animal units.....	576.41
Increase due to one animal unit.....	15.80

TABLE VII (Tabulation LXIII).—*Acres of feedable crops and pasture per animal unit—378 owner farms, Chester County, Pa.*

Acreage of farms.	40 or less.	41-60	61-80	81-100	101-120	121-160	Over 160.	All farms.
Number of farms....	54	61	60	68	52	61	22	378
Number of animal units per farm.....	7.6	12.5	16.6	20.2	24.4	26.7	41.8	19.4
Per animal unit.								
Corn for grain.....	0.60	0.59	0.60	0.62	0.63	0.62	0.68	0.62
Corn for silage.....								
Other corn.....								
Oats and other grains for feed.....	.13	.14	.18	.20	.17	.19	.22	.18
All hay.....	.99	1.05	1.22	1.26	1.15	1.40	1.26	1.23
Total feed crops.....	1.72	1.78	2.00	2.08	1.95	2.21	2.16	2.03
Pasture ¹.....	.88	1.08	1.10	1.08	1.23	1.27	1.41	1.18
Grand total....	2.60	2.86	3.10	3.16	3.18	3.48	3.57	3.21
Value of farm feeds sold.....	\$13.43	\$15.37	\$20.55	\$20.80	\$17.94	\$25.41	\$30.25	\$21.08
Value of feed purchased.....	12.75	8.85	9.61	9.36	11.10	8.34	13.37	10.11

¹ Does not include work horses.

TABLE VIII (Tabulation LXXIV).—*Showing depreciation of dairy cows—378 farms operated by owners, Pennsylvania.*

	Number.	Value per head.	Total value.
First inventory.....	4,196	\$56.10	\$235,400
Cows purchased.....	589	63.84	37,605
Cows raised.....	345	63.84	22,025
Total.....			295,030
Second inventory.....	4,164	57.01	237,430
Cows sold and slaughtered.....	895	37.36	33,437
Total.....			270,867
Difference.....			24,163
Increase at end of year in value.....		.91	3,789
Total loss.....			27,952
Average investment.....			236,415
Rate of depreciation.....per cent..			11.82

TABLE IX (Tabulation LXXV).—*Showing depreciation of horses—378 farms operated by owners, Chester County, Pa.*

	Number.	Value per head.	Total value.
Value at first inventory.....	1,369	\$135.98	\$186,183
Value of horses purchased.....	103	157.36	16,208
Value of horses raised.....	8	157.36	1,259
Total.....			203,650
Value at second inventory.....	1,367	138.95	189,947
Value of horses sold.....	64	128.02	8,193
Total.....			198,140
Loss.....			5,510
Increase in price during year.....		2.97	4,060
Total loss.....			9,570
Average investment.....			188,065
Rate of depreciation.....per cent..			5.09

